

POLICY PAPER

WAKE-UP CALL:

ECONOMIC CRISIS NEEDS TO FORCE LEBANON TOWARDS A GREEN RECOVERY

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SALVATION FROM ACCUMULATED CRISES CAN ONLY BE THROUGH SUSTAINABLE CONSUMPTION AND PRODUCTION





EXECUTIVE SUMMARY

In early November 2021, governments made bold commitments to net-zero carbon emissions by 2050 at the COP26 UN Climate Change Conference in Glasgow. Staggeringly, Lebanon's Prime Minister Najib Mikati claimed his nation was "at the forefront of countries seeking to achieve human and environmental sustainability."

Mikati's assertion defies belief. Lebanon lags well behind its regional neighbours in adopting green reforms. The Lebanese state, private sector, and individuals all rely overwhelmingly on imported fuel oils to drive activity. While Jordan strides towards becoming a renewables exporter, Lebanon produces barely any power from renewables. Now, the crippling economic crisis will force Lebanon towards a green economic recovery. Put simply, Lebanon no longer has the money to maintain its wasteful and high polluting means of economic production.

This summer's fuel crisis revealed the leading obstacle to Lebanon's economic recovery: energy security. The country ground to a virtual standstill for weeks, as importers refused to bring fuel oil into the country unless they benefited from subsidies or were able to sell at global market prices. Without delay, the country must replace all diesel and fuel-oil power generation with natural gas by 2025 and rapidly expand solar and wind energy capacities toward a minimum 50% target by 2030.

Adopting green energy practices will reduce alarming environmental and public health impacts of the current economic structure, and produce relatively high levels of direct and indirect employment. In parallel the economic recovery requires energy efficiency reforms across all sectors.

The economic crisis must catalyse everyday Lebanese to cut back on household expenses by using energy-efficient appliances, take shared transport, use renewable energy sources, and build sustainable houses. The future will need to be one where Nargileh café staff will no longer be able to fan their coals using hair dryers, or by driving around the block on a scooter twirling the molten ashes like dystopic carbon cowboys.

The more ambitious the change, the more Lebanon stands to gain. Well-evidenced scenarios show that if by 2030 Lebanon relied on close to 50% renewable energy – the amount required to reduce greenhouse gas emissions by 30% – it would generate net savings of US\$5.8 billion and add 17% of local value-added GDP to the economy. A 30% renewables target by 2030 would gain less than half of the possible economic benefits.^{1,2}

The green transition comes at an unavoidable price. Lebanon's regulatory frameworks must be amended and implemented thoroughly to a) enable international funders to trust funding will benefit the population and not be squandered or siphoned-off, and b) ensure, industry, households and businesses establish new practices and modes of production and consumption.

The long-term erosion of the rule of law in Lebanon means that this requires leadership beyond the empty promises and blatantly false statements from Lebanon's political class. Civil society and independent political groups vying for power in upcoming elections—be they national, municipal or at the syndicate level—should adopt the green transition as the cornerstone of their alternative pitch to Lebanese society.



GETTING ON TRACK

The world's most polluting sectors have been set milestones that must be met to keep the global community on track for net-zero emissions by 2050.³ Advanced economies are expected to be ahead of developing economies in major components such as electrification of industry and transport, as well as in phasing out hydrocarbon power production.⁴ Developing economies such as Lebanon however have an imperative to leap-frog some of the advanced economies' transition stages via the rapid implementation of technological and regulatory advances.

The transition to net-zero emissions is not however solely about energy use. It is also about cultural and behavioural change across all modes of consumption and production, which transform the current disposable and 'cheapest possible' attitudes, to circular, self-supporting economic models that recognise and work within natural limits.

In Lebanon's context the most pertinent components of a transition to net-zero emissions will be regulatory reform that orients investment and business practices

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towards circular economy practices; rapid expansion of renewable energy capacity; the establishment and implementation of green building and construction codes; electrification of heating and water infrastructure; major decreases in private vehicle use in favour of public transport; green job creation; climate adaptation; and halting any exploration of oil and gas.

THE FIRST HURDLE: ENERGY SECURITY

Lebanon's economy simply cannot recover without first arresting the nation's chronic energy insecurity. The World Energy Council measures a country's energy status with a "tri-lemma index" comprised of energy security, energy equity and sustainability. Energy security is broken down into import dependence, diversity of electricity generation, and energy storage. Lebanon had a total score of just 27.7 out of 100; alarmingly, it did not even register a score for generation diversity. This rating reflects the reality of a national production system that overwhelmingly relies on a single type of fuel. The brittle nature of this energy mix became all too apparent in summer 2021, when the country endured a crippling, extended fuel shortage. As foreign currency reserves dwindle even further, it will only become more untenable to rely on imported fuel oil.

The lack of energy security looms as an enormous obstacle to Lebanon's economic recovery. Since the civil war, unreliable energy services have constricted the growth of businesses, especially those that rely on constant streams of electricity to operate effectively. Even companies which do not rely on continuous power, must contend with paying multiple electricity bills – to state-owned Électricité Du Liban (EDL), and to the owners of supplementary, diesel-fuelled generators.



Energy insecurity has racked up huge opportunity costs for Lebanese commerce. Blackouts alone are estimated to have cost the economy US\$3.9 billion per year in lost productivity and assets⁵, while US\$5.4 billion would be saved in health care spending if cleaner, reliable energy became a reality.⁶

Unable to continue relying on imported fuel oil, Lebanon will need to adopt cleaner energy sources immediately. Regional energy linkages – beyond longstanding oil and gas pipelines – will support Lebanon’s renewable energy expansion beyond domestic capabilities.

Throughout West Asia and North Africa, countries are set to become renewable energy exporters, due to their large available land masses and high hours of sun exposure. One such country is Jordan,⁷ which, coincidentally, will begin providing electricity to Lebanon via Syria in early 2022.⁸ Such a scenario will allow Lebanon to continue renewable energy growth beyond a 2030 goal of 53% gas and 47% renewable energy.⁹ In the meantime, EDL can derive around 40% of power generation capacity from natural gas, a less expensive and cleaner alternative to heavy fuel oils.^{10,11} Lebanon would stand to save \$300 million annually through the natural gas component of the switch alone, with far greater financial benefits to flow from switching to renewables.

Using cleaner sources to bolster energy security would bring not only environmental benefits, but social and public health gains too. In 2021, the country faces any number of social and economic challenges that can be traced – at least in part – to the national process for energy production. People’s mental and physical health suffer from breathing in polluted air and

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enduring uncertain electricity access – an estimated 2700 people die each year in Lebanon from fossil-fuel attributed air pollution¹² – and trust between citizens and the state continues to degrade, as everyday Lebanese witness politicians’ unwillingness to adopt serious reforms.

THE SECOND HURDLE: ENERGY EFFICIENCY

Changes to supply-side dynamics alone are not enough to bring about the scope of change needed for Lebanon. In 2018, Lebanon emitted 4.04 metric tons of carbon dioxide per capita, while neighbouring Jordan, which uses much less fuel oil and more renewable energy and gas emitted 2.47 metric tons per capita.¹³ What’s more, Lebanon’s energy consumption is set to grow by an estimated 7% per year to 2030.¹⁴ Such growth must be met by energy efficiency measures across infrastructure, appliances, and individual behaviours.

Lebanon’s reliance on costly electricity production would nosedive if energy efficiency promotion were taken seriously. The 2016 National Energy Efficiency Action Plan (NEEAP) – the 2021 update of which was yet to be published at the time of writing – identifies



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14 primary initiatives that, if implemented, would reduce electricity power demand by 4.83% of 2020 usage levels. However, the initiative to promote energy efficient equipment had only achieved 8% implementation by 2016.¹⁵ Based on the government's own NEEAP, total national electricity consumption from appliances would drop from 4,250 gigawatt hours (GWh) per year to 3,244 GWh per year by 2025 – a 24% improvement.¹⁶ In the industrial sector, energy efficiency measures have already achieved an average 39% reduction in energy costs.¹⁷ Yet to date, Lebanese consumers remain largely unaware of energy efficiency ratings for appliances. To make matters worse, limited finances sometimes make it difficult to upgrade to more expensive technology.¹⁸

TRANSPORT: DRIVE TOWARDS THE GREEN LIGHT

The transport sector currently imposes untold difficulties on Lebanon's economic development. Lebanese commuters rely heavily on private cars instead of public transport. The widespread use of privately owned vehicles contributes to the transport sector draining more than 40% of Lebanon's oil consumption – an unaffordable burden on almost all consumers' pockets. Omnipresent private cars further damage economic

productivity by driving up traffic congestion. Each year, Lebanese commuters spend an average of 720 out of 4,380 productive hours on the road, costing an estimated US\$3 billion per year in GDP.¹⁹ The problem is compounded by a lack of decentralised service and job provision outside of Beirut. Over 500,000 cars enter Beirut each day to access, jobs, schools and services that are not available elsewhere.²⁰

The only viable alternative for Lebanese commuting is revitalised public transport networks, which would also reduce the country's carbon footprint. At present, the transport sector is responsible for 23% of overall greenhouse gas emissions, while also being the country's main source of urban air pollution.²¹ Within Beirut, public transport accounts for no more than 20% of all trips. Most of these journeys occur in a shared taxi, or service, with just 2% of trips taking place in buses and vans.²² Now that Lebanese commuters struggle to meet rising fuel costs, it will make economic and social sense to boost Lebanon's public transport capacity, starting with the restructuring and modernization of the bus system. Electric vehicles will become more widespread, contingent on meeting upfront capital requirements and improving Lebanon's energy security. Implementing these direct measures alone, without decentralisation, would do more than slash fuel bills. They would also bring down transport sector carbon emissions by 67% by 2040, compared to a business-as-usual scenario.

BOX I: Sharing Economy Box

In economic models centred on sustainability and circularity, waste and pollution are considered design flaws rather than inevitable by-products.²³ One of the main differences from current consumption practices is in designing products to be reused, repaired or



remanufactured, and keeping them in circulation so they do not end up in landfills.

Cases of acute and long-term crisis have often been major drivers for moves towards resource efficiency. Cuba for example is ranked as the world's most sustainably developed country – a situation that has occurred both through policy and necessity.²⁴ Similarly Lebanon in 2021 is being driven by necessity of its import limitations to rapidly move toward more sustainable practices. Across all sectors these practices are often characterised by new modes of capital ownership based on sharing – through co-sharing, leasing, and collaboration – rather than outright ownership.

There is also a business case to be made in support of the sharing economy. Businesses incur lower capital ownership costs and get more use value from their capital over its lifespan, while individuals who cannot afford things outright or do not use them often, can still gain access to goods and services at cheaper rates based on subscription and rental agreements. Increasingly driven by corporate social responsibility, as well as long-term environmental risk assessments, investors are also more inclined to fund enterprises that are following circular economic principles.

accounts for nearly 10% of the country's carbon dioxide emissions – of which cement manufacturing is responsible for 91.6% – while comprising only 3.8% of GDP.²⁵

Lebanon's resource and capital scarce economic context is already pushing industry toward sustainability measures. Lebanese industry is the largest investor in renewable energy, given renewables' superiority for business productivity and reliability compared to EDL's electricity supply. Currently, 20% of all rooftop photovoltaic systems are installed within the commercial sector.²⁶ Local products such as high quality local agricultural compost and recycled tyres are seeing demand growth as their products now out-compete imported alternatives.²⁷

The 2015 Sustainable Consumption And Production Action Plan For The Industrial Sector highlighted that improving Lebanon's trade balance through producing and exporting highly sophisticated products was a priority for moving the economy towards a more sustainable footing.²⁸ The report noted Lebanon as a regional exception in its production of highly sophisticated products and indicated the industrial sector should promote whole-of-life cycle approaches and eco-design to capitalise on Lebanon's free trade agreement with the EU, as well as other trading relationships.²⁹

CONSTRUCTION AND INDUSTRY: BUILD BACK GREENER

The construction and industrial sectors are large contributors to Lebanon's ruinous import dependence. Both sectors have been reliant on imported inputs and high-polluting practices. Construction industry stakeholders estimate that of non-concrete materials, 90% are imported and the construction sector

WASTE MANAGEMENT: WASTE NOT WANT NOT

Lebanon's waste crisis represents the symbolic inverse of its vast import expenditure. The money used to buy those goods has run out and so has the land space for dumping them afterward. Instead of bundling up the waste and dumping it into the sea



as “land reclamation,” Lebanon needs whole of life-cycle solutions to consumption and waste, that also derive major change from behavioural practices and efficiency measures.³⁰

Emissions from waste and wastewater, contribute to 10.7% of Lebanon’s total greenhouse gas emissions – largely derived from the decomposition and burning of waste in dumped at the 504 municipal waste dumpsites spread around the country, and the discharge of wastewater without prior treatment in the Mediterranean sea, riverbeds and septic tanks.³¹

Encouragingly (or dishearteningly), most of Lebanon’s waste can already be recycled. Around 80-90% percent of current refuse could be dealt with sustainably, without relying on landfills.³² Waste management solutions in Lebanon’s context require interventions at the generation, recovery, and processing stages – with parallel efforts to change cultural attitudes at all stages. Market interventions such as Extended Producer Responsibility (EPR) systems are also needed to push manufacturers to use reusable or recyclable products and be held responsible for the lifecycle of their products.³³ Recycling industries already show potential for job creation if they can be formalised and expanded. Prior to 2019, 10% of Lebanon’s exports came from exported scrap metal largely collected by informal workers.³⁴

GREEN BUILDING CODES: A GOOD HOME IS A GREEN ONE

Most Lebanese households pay unnecessarily high electricity bills due, in part, to weak building codes and energy-inefficient housing. In other countries, homeowners make huge savings from constructing

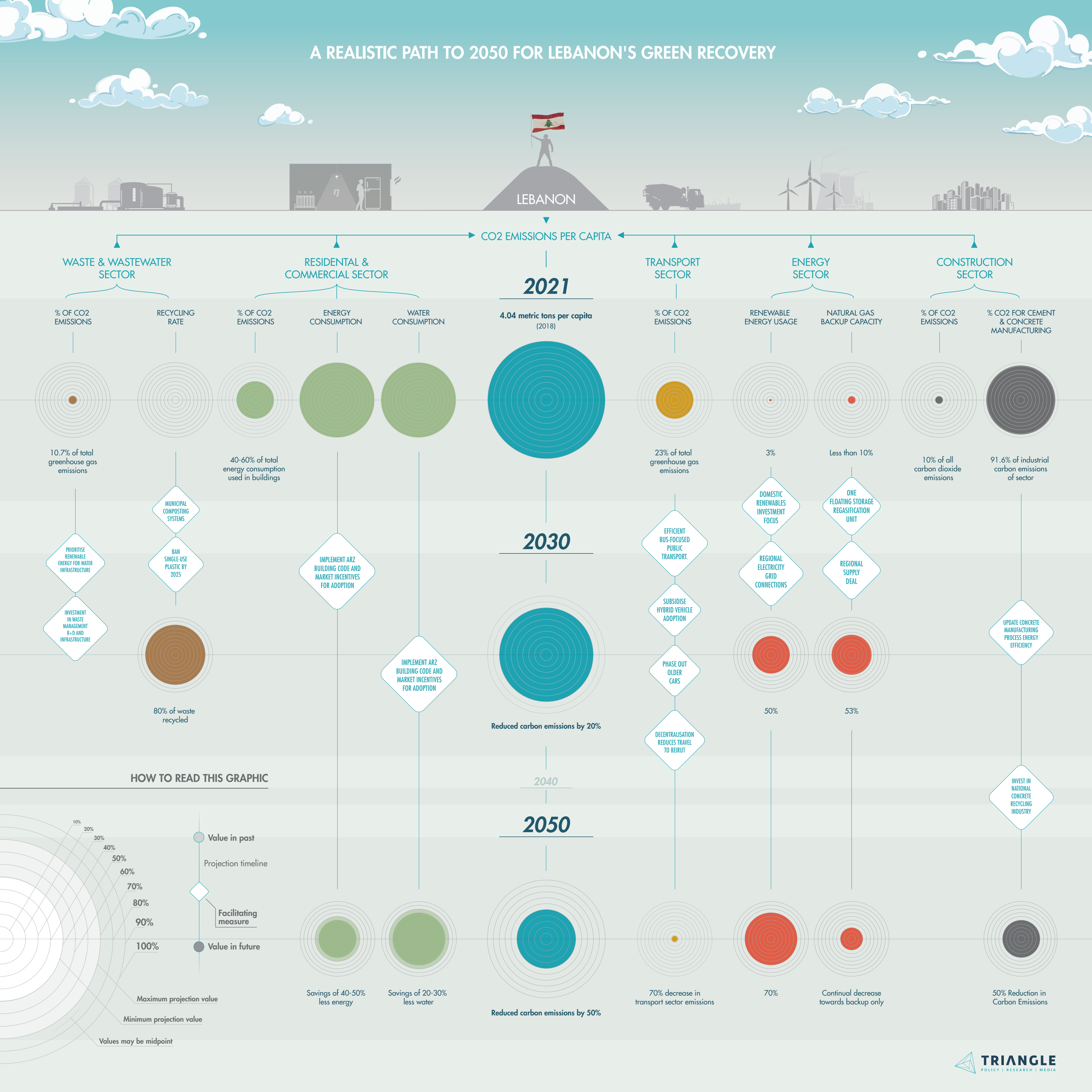
energy efficient houses. In India, certified green buildings used 40 - 50% less energy and 20 - 30% less water compared to conventional buildings. In more resource-hungry developed nations such as Australia, the gains were even higher.³⁵ These savings lead to lower bills for residents and business occupants, lower construction costs and even higher property values.

At present, Lebanese regulations do little to incentivise builders or citizens to construct energy-efficient houses. The current building code includes only the most basic sustainability and energy measures such as mandated double-layer walls, and minimum levels of glass on the exterior of the building. The Lebanese Green Building Council (LGBC) has developed a green buildings ratings system (ARZ) based on international best practice. Uptake of ARZ has so far been weak. Nevertheless, the LGBC is working with the Order of Engineers and Architects in Beirut and Tripoli to incorporate the ratings system into existing permit processes.³⁶

Now, Lebanon’s economic crisis is taking over in incentivising homeowners to adopt more sustainable building techniques. Many new construction materials have become prohibitively expensive, leading builders to show increased interest in recycled inputs – regardless of government (in)action. Building codes can support this trend by ensuring sustainable procurement and construction, while also regulating material quality and standards. These steps would ensure that sustainability measures are maximised throughout the value-chain.³⁷

As suggested by the name, green building can make a massive contribution to Lebanon’s environmental recovery. As the primary source of energy and material consumption, buildings and the regulations

A REALISTIC PATH TO 2050 FOR LEBANON'S GREEN RECOVERY



CO2 EMISSIONS PER CAPITA

2021

4.04 metric tons per capita (2018)

2030

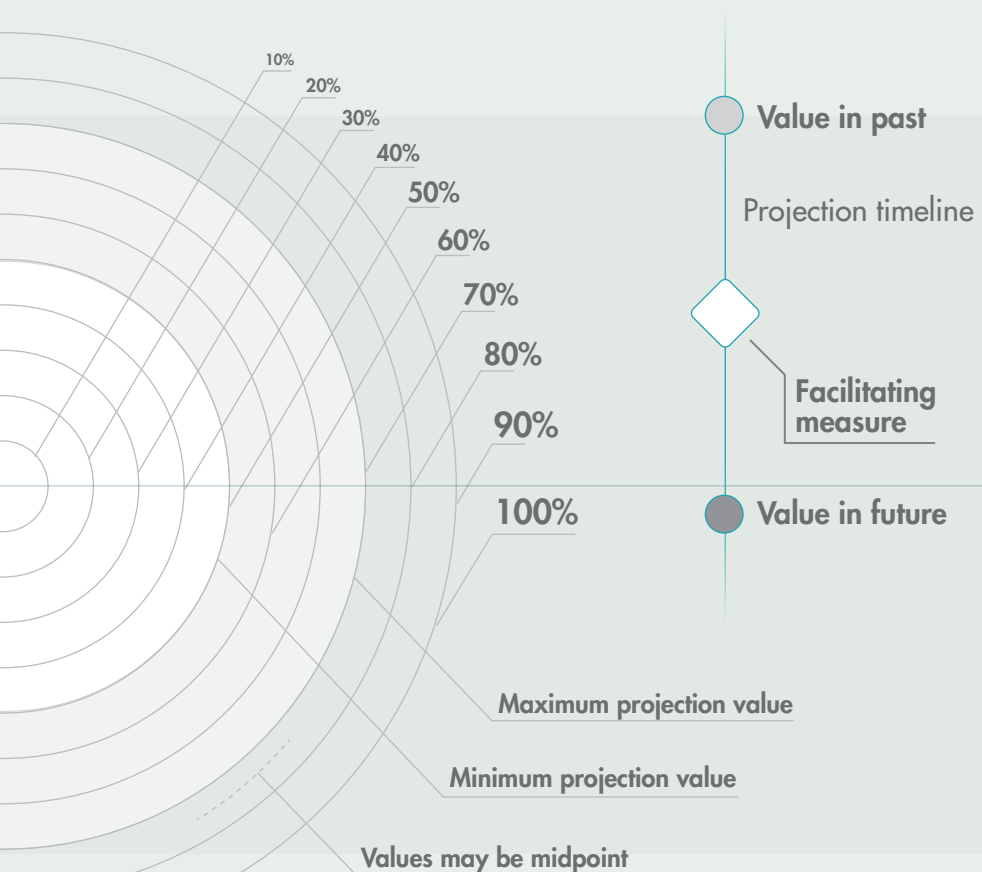
Reduced carbon emissions by 20%

2040

2050

Reduced carbon emissions by 50%

HOW TO READ THIS GRAPHIC





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“Instead of being in a position to capture US\$600 million in available export gains, Lebanon is seeing basic foods banned from key export destinations due to bacterial and chemical contamination.”

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on their design and construction are key entry points of control for up-and down-stream sustainability gains.³⁸ The building sector has some of the highest potential for reducing greenhouse gas emissions – estimated at a potential 50% cut in current carbon emissions by 2050 – through direct measures in building design and energy sourcing.³⁹

WATER: NOT A DRINKABLE DROP

Lebanon’s outmoded water sector does not only leak precious water – it also allows money to slip through the cracks. Successive governments have almost entirely neglected national water management, failing to update infrastructure or improve distribution efficiency. In response, many Lebanese rely on private companies to provide water trucks when taps run dry. Less scrupulous businesses and individuals use illegal private wells or tap into state-owned pipes to guarantee more supply. Poor maintenance and water theft impose massive financial burdens on regional water establishments, while also wreaking widespread destruction on water sources and ecosystems across the country.^{40,41} To make matters worse, Lebanon’s water system is also highly vulnerable to shocks, given its total reliance on imported fuels – placing water supply in the same slowly sinking ship as the national energy sector.⁴²

Yet again, Lebanon’s most economically viable alternative is for the water sector to adopt resource efficiency and cleaner production standards.

Companies and households alike can reduce their water bills, while boosting their overall water supply, by adopting simple sustainability measures. For instance, eight Lebanese agro-food businesses reduced their annual water consumption by a total of 53,412 m³ during a trial of international-standard sustainability upgrades. The required investment had an average payback time of less than 12 months and bore accumulated annual savings of €1.6 million (comprising both water and energy consumption reductions).⁴³

Lebanon’s water pollution is so unsustainable it is harming both human and environmental health, as well as limiting the economic potential of the agricultural sector. Instead of being in a position to capture US\$600 million in available export gains,⁴⁴ Lebanon is seeing basic foods banned from key export destinations due to bacterial and chemical contamination.⁴⁵ It doesn’t help that nearly 80% of bottled water and the majority of the country’s irrigation aquifers are also chemically or biologically contaminated.^{46, 47,48}

Box II: Job creation

The private sector will be the driving force for sustainable economic growth in Lebanon. With the right regulatory and policy mix they can be supported to create the sharing, re-use and sustainable industries that are needed to pull Lebanon out of its current collapse.⁴⁹ Over 90% of Lebanese businesses are micro, small, or medium enterprises and employ over 50% of the national



workforce. These businesses will need to expand into the sharing and re-use economies to absorb the necessary trimming of the bloated public sector.⁵⁰

Being labour-intensive, sustainability promoting projects – including renewable energy – can provide higher levels of long-term direct and indirect employment. These are jobs created in design and planning, installation, transportation and logistics, and operation and maintenance, organic farming and marketing, energy-efficient building construction, repair, and recycling.⁵¹ On average, investment in renewable energy and energy efficiency generates five times as many jobs per US\$1 million than investments in fossil fuels.⁵² For Lebanon a target of 50% renewables by 2030 would create over 2700 jobs, 68% percent of which would be in usually neglected rural areas. Similarly, every US\$1 million invested in green buildings in Lebanon creates around 45 jobs.⁵³

RECOMMENDATIONS

Despite what the current or previous heads of state have promised or claimed, Lebanon has not taken the steps toward the kind of transition that would invoke a real green transition. No matter what the future holds one thing is clear, countries that do not sign on to the green transition will be left behind by those that do, both in economic and social outcomes.

Energy reform is the cornerstone of that transition. Lebanon needs to rapidly pursue a target of 50% renewable energy by 2030. It can accelerate this achievement by making proactive moves to import renewable energy from regional exporters,⁵⁴ as well as implementing the legally mandated ERA and other enabling legislation for distributed renewable energy production.

The government must support, enable or at least not hinder increased funding for research, development and innovation in green industries. The creation of locally sourced materials for industry and consumers is a crucial step in reducing the nations import-export deficit.⁵⁵ Interventions should be targeted toward value-added and highly sophisticated exports that require the skills of Lebanon's young highly educated population. Urban areas with concentrations of highly-skilled youth and research hubs, should also be supported by improving cooperation between public research institutions and the private sector, to better coordinate the green transition.⁵⁶

A circular waste management strategy must also be put in place, and must go beyond technical solutions to disposing of waste and include life-cycle solutions, such as policies that reduce the production and import of non-recyclable materials, or single-use products and provide financial incentives to businesses to build reusability into their designs.

The short-medium term imperative for most Lebanese to save every lira they can means energy efficiency awareness and education have become top public priorities. Tax and trade incentives for energy-efficient



"Interventions should be targeted toward value-added and highly sophisticated exports that require the skills of Lebanon's young highly educated population."





and repaired and/or recycled products must be implemented to hasten the uptake of less wasteful electrical appliances. Market incentives including taxes, subsidies and favourable loans that support green industries and punish polluting ones will help direct the private sector producers, service providers and consumers to integrate circularity principles into their activities and practices. Public procurement can be an important source of funding for emerging businesses and technologies and should follow stringent sustainability standards.

The ministries of water and agriculture must be overhauled and properly funded to begin fulfilling their basic regulatory and implementation duties. Key initiatives for these sectors will be consolidation of the waste-water treatment system, wide-spread subsidies for agricultural training and materials, the establishment of regulated agricultural cooperatives, and expansion of local composting infrastructure.

Vocational training for rural communities should be designed to support the needs of renewable energy companies, as well as upskilling in sustainable agricultural methods.⁵⁷ Regional private sector initiatives are already supporting companies working on providing more sustainable water or energy solutions for agriculture, with technical assistance, investment facilitation, and grants of up to US\$1 million.

Of course, Lebanon's has long relied on one source of fuel for a reason—political interests and lobbying. To move past fossil fuels being the only source of energy in the country, civil society and independent political will have to adopt the green transition as their fight. It's no coincidence that the full range of detailed regulatory and policy instruments which have for decades been established and communicated to the government of

Lebanon have never been implemented. Among the main instruments are establishing a streamlined process for renewable energy production permits; transparent contract enforcement and recourse mechanisms; and fostering financial sector reform towards green infrastructure investment.

The end of fuel subsidies removes one of the main policy mechanisms used by the political establishment to placate the population. While the situation is now dire for the vast majority of Lebanese who cannot afford the price hikes that come with subsidy removal, it is also an opportunity to recover by leaving fossil fuels behind. As renewable energy sources start to power different sectors, fuel must be disincentivised by gradually increasing taxes and tariffs – the revenue from which is put towards funding renewable energy projects and access for vulnerable populations. A similarly punitive taxation approach must be applied to all sectors where rapid sustainability transitions are required.⁵⁸

A green transition is not a pipe dream for Lebanon, it's a survival guide which needs to be employed to save the country from its socioeconomic destitution. Anything less means the country will plummet further into despair, and is left behind in the global shift towards a greener, and better future for all.

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REFERENCES AND ENDNOTES

- 1 AUB (2019) "Lebanon's Electricity Sector – Leapfrogging to Higher Penetration of Renewables", online at https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEWjZhzUnsXzAhUPlhQKHYS8BmcQFnoECAIQAAQ&url=https%3A%2F%2Fwww.lfre.org%2F%2Fstrategy-AUB-LFRE-final-report-Leapfrog-May-2019.pdf&usq=AOvVaw3Avr9_FZr31F_5BmX6LHF
- 2 Kulluna Irada, LFRE (2020) "Taking Politics out of the Electricity Plan Towards an Ambitious Energy Transition"
- 3 IEA (2021) "Net-Zero by 2050: A Roadmap For the Global Energy Sector," International Energy Agency, online at <https://www.iea.org/reports/net-zero-by-2050>
- 4 Ibid.
- 5 Bouri, E and El Assad, J. (2016) "The Lebanese Electricity Woes: An Estimation of the Economical Costs of Power Interruptions", *Energies*, July 2016
- 6 Ayoub, M (2021) "Can Renewables Be the Answer to Lebanon's Energy Crisis?" Lebanese Centre for Policy Studies, online seminar available at <https://www.facebook.com/LebaneseCenterforPolicyStudies/videos/322065696372700>
- 7 Jordan Times (2018) "Renewable energy investments in Jordan to reach \$4 billion in 2020 — Zawati", *Jordan Times*, 18 December 2018, online at <https://www.jordantimes.com/news/local/renewable-energy-investments-jordan-reach-4-billion-2020-%E2%80%94-zawati>
- 8 Ibid.
- 9 LFRE (2019) "Lebanon's Electricity Sector – Leapfrogging to Higher Penetration of Renewables", Lebanese Foundation for Renewable Energy, online at https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEWjTsQj1yNnzAhXQxoUKHXifCiYQFnoECAUQA-Q&url=https%3A%2F%2Fwww.lfre.org%2F%2Fstrategy-AUB-LFRE-final-report-Leapfrog-May-2019.pdf&usq=AOvVaw3Avr9_FZr31F_5BmX6LHF
- 10 Ayat C (2021) "How to Rebuild the Lebanese Electricity Sector: From Black to Green" *An-Nahar* 11 October 2021, online at <https://www.annahar.com/arabic/special-issues/%D8%A8%D9%84%D8%AF-%D8%B9%D9%86-%D8%B6%D8%A7%D8%A6%D8%B9/09102021090008769>
- 11 Hatoum L (2020) "Why Lebanon's Electricity Crisis Is So Hard To Fix – Analysis" *Eurasia Review* <https://www.eurasiareview.com/15062020-why-lebanons-electricity-crisis-is-so-hard-to-fix-analysis/>
- 12 Greenpeace (2020) "Toxic Air: The Price of Fossil Fuels" Greenpeace MENA, <https://storage.googleapis.com/planet4-mena-stateless/2020/06/d2f9f552-gp-mena-air-pollution-report-eng-june-2020-.pdf>
- 13 World Bank (2018) "CO2 Emissions Per Capita, Lebanon and Jordan" World Bank Data Hub, online at <https://data.worldbank.org/indicator/EN.ATM.CO2E.PC?locations=LB-JO>
- 14 MoEW (2016) "The Second National Energy Efficiency Action Plan For The Republic Of Lebanon Neeap 2016-2020" Lebanon Ministry of Energy and Water, online at <https://data2.unhcr.org/en/documents/download/64713>
- 15 MoEW (2016) "The Second National Energy Efficiency Action Plan For The Republic Of Lebanon Neeap 2016-2020" Lebanon Ministry of Energy and Water, online at <https://data2.unhcr.org/en/documents/download/64713>
- 16 LCEC (2020) "Availability, Efficiency & Use of Home Appliances in Lebanon" Lebanese Centre for Energy Conservation, online at https://www.lcec.org.lb/sites/default/files/2021-03/LCEC%20IEEHA%20REPORT%20E%20FOR%20WEB_1.pdf
- 17 UNDP (2016) "Energy Efficiency in the Lebanese Industrial Sector" United Nations Development Programme, online at <https://www.lb.undp.org/content/lebanon/en/home/library/energy-efficiency-in-the-lebanese-industrial-sector.html>
- 18 UNDP (2018) "Energy Efficient Home Appliances: Perspectives From Lebanese Consumers", United Nations Development Programme, online at https://www.undp.org/content/dam/lebanon/docs/Energy%20and%20Environment/Publications/CEDRO%20_%20Energy%20Efficient%20Home%20Appliances.pdf
- 19 Kadi, S. (2018) "Traffic congestion adds to Lebanon's many woes" <https://thearabweekly.com/traffic-congestion-adds-lebanons-many-woes>
- 20 Kadi, S. (2018) "Traffic congestion adds to Lebanon's many woes" <https://thearabweekly.com/traffic-congestion-adds-lebanons-many-woes>
- 21 (MoEW) (2016) "Lebanon's Third National Communication to the UN Framework Convention on Climate Change", Lebanon Ministry of Energy and Water, online at <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEWjQsOKk6tjzAhXj4IUKHRtLDIsQFnoECAoQA-Q&url=https%3A%2F%2Funfccc.int%2Fsites%2Fdefault%2Ffiles%2Fresource%2Flnnc3.pdf&usq=AOvVaw3Ud2bxFc73Cl-37BZB368>
- 22 UITP (2019) "MENA Transport Report 2019" Union Internationale des Transports Publics, online at <https://www.uitp.org/publications/mena-transport-report-2019/>
- 23 EMF (2021) "Circular Economy Introduction", Ellen MacArthur Foundation, online at <https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview>
- 24 Trinder M (2020) "Cuba found to be the most sustainably developed country in the world, new research finds" *Studio For Sustainability and Social Action*, Penn State University, online at <https://sites.psu.edu/sovas3a/2020/02/03/cuba-found-to-be-the-most-sustainably-developed-country-in-the-world-new-research-finds/>
- 25 (MoEW) (2016) "Lebanon's Third National Communication to the UN Framework Convention on Climate Change", Lebanon Ministry of Energy and Water, online at <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEWjQsOKk6tjzAhXj4IUKHRtLDIsQFnoECAoQA-Q&url=https%3A%2F%2Funfccc.int%2Fsites%2Fdefault%2Ffiles%2Fresource%2Flnnc3.pdf&usq=AOvVaw3Ud2bxFc73Cl-37BZB368>
- 26 Farhat, W. (2019). The 2018 Solar PV Status Report for Lebanon, LCEC, <https://beirutenergyforum.com/files2019/The%202018%20Solar%20PV%20Status%20Report%20for%20Lebanon.pdf>
- 27 Maya Karkour (2021) "Panel 3 - Edition 2: On the concept of circular economy to revive local production and consumption", Lebanon Talks, available online at <https://www.youtube.com/watch?v=XZWWnA8ntml>
- 28 MoE (2015) "Sustainable Consumption And Production Action Plan For The Industrial Sector In Lebanon", Lebanon Ministry Of Environment, <https://switchmed.eu/Wp-Content/Uploads/2020/04/01.-SCP-NAP-Lebanon.Pdf>
- 29 Kassem, Z. (2021) "Panel 3 - Edition 2: On the concept of circular economy to revive local production and consumption", Lebanon Talks, available online at <https://www.youtube.com/watch?v=XZWWnA8ntml>
- 30 Verdeil, E. (2021) "Seafont Reclamations, Rubble, and Waste: A Metabolic Reading of Lebanese Urbanization", *The Derivative*, online at <https://thederivative.org/for-rubble-%D8%B1-%D8%AF-%D9%85/>
- 31 (MoEW) (2016) "Lebanon's Third National Communication to the UN Framework Convention on Climate Change", Lebanon Ministry of Energy and Water, online at <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEWjQsOKk6tjzAhXj4IUKHRtLDIsQFnoECAoQA-Q&url=https%3A%2F%2Funfccc.int%2Fsites%2Fdefault%2Ffiles%2Fresource%2Flnnc3.pdf&usq=AOvVaw3Ud2bxFc73Cl-37BZB368>
- 32 HRW (2020) "Lebanon: Huge Cost of Inaction in Trash Crisis", Human Rights Watch, online at <https://www.hrw.org/news/2020/06/09/lebanon-huge-cost-inaction-trash-crisis>
- 33 ISWA (2020) "Lebanon and Circular Economy" ISWA, online at <https://iswalebanon.org/blog/lebanon-and-circular-economy/>
- 34 Saleh, E. (2021) "Recycling Policies from the Bottom Up: Waste Work in Lebanon," *Arab Reform Initiative*, online at <https://www.arab-reform.net/publication/recycling-policies-from-the-bottom-up-waste-work-in-lebanon/>
- 35 WGBC (2021) "The benefits of green buildings" World Green Building Council, Online at <https://www.worldgbc.org/benefits-green-buildings>
- 36 Interview with Pierre Dammous, President of Lebanese Green Building Council, 27 October 2021.
- 37 Ibid.
- 38 EEA (2020) Cutting greenhouse gas emissions through circular economy actions in the buildings sector, European Environment Agency, online at <https://www.eea.europa.eu/themes/climate/cutting-greenhouse-gas-emissions-through/cutting-greenhouse-gas-emissions-through>
- 39 WGBC (2021) "The benefits of green buildings" World Green Building Council, Online at <https://www.worldgbc.org/benefits-green-buildings>
- 40 Eid-Sabbagh, K. and Ray, A. (2021) "Breaking Point: The Collapse of Lebanon's Water Sector", *Triangle*, online at <https://www.thinktriangle.net/breaking-point-the-collapse-of-lebanons-water-sector/>
- 41 MoE (2015) "Sustainable Consumption And Production Action Plan For The Industrial Sector In Lebanon", Lebanon Ministry Of Environment, <https://switchmed.eu/Wp-Content/Uploads/2020/04/01.-SCP-NAP-Lebanon.Pdf>
- 42 MoEW (2021) "Water-Energy Nexus Of Water and Wastewater Services In Lebanon," Lebanon Ministry of Energy and Water https://www.aub.edu.lb/ifi/Documents/publications/research_reports/2020-2021/202106_water_energy_nexus_volume_1_.pdf



- 43 SwitchMed (2018) "Resource efficiency is a major opportunity for industries, the economy and the environment in Lebanon," SwitchMed Magazine, online at <https://switchmed.eu/wp-content/uploads/2020/03/National-Supplement-EN-Lebanon-1.pdf>
- 44 World Bank (2018) "The role of food and agriculture for job creation and poverty reduction in Jordan and Lebanon" World Bank, online at <https://documents.worldbank.org/curated/en/325551536597194695/pdf/Agricultural-Sector-Note-Jordan-and-Lebanon.pdf>
- 45 Abdallah H (2021) "Qatar recalls some vegetables from Lebanon over 'E.coli concerns': reports" Doha News, 28 October, 2021, online at <https://www.dohanews.co/qatar-recalls-some-vegetables-from-lebanon-over-e-coli-concerns-reports/>
- 46 Massena F (2017) "Water pollution in Lebanon reaching dangerous levels" <https://www.al-monitor.com/originals/2017/07/lebanon-water-pollution-garbage-crisis.html>
- 47 Shaaban, A. (2020) "Rivers of Lebanon: Significant Water Resources under Threats", Intechopen, Online at <https://www.intechopen.com/chapters/73655>
- 48 Assaad N. et.al (2021) " Heavy Metals Accumulation in the Edible Vegetables of Lebanese Tabbouli Salad" Journal of Agricultural Science; Vol. 12, No. 7; 2020 ISSN 1916-9752 E-ISSN 1916-9760 Published by Canadian Center of Science and Education 155, online at <https://www.ccsenet.org/journal/index.php/jas/article/download/0/0/43040/45032>
- 49 AUB (2020) "SMEs in Lebanon: An untapped force for recovery", Suliman S. Olayan School of Business, online at: <https://www.aub.edu.lb/osb/news/Pages/SMEs-in-Lebanon.aspx>
- 50 Abi-Shaker Z. (2021) "Panel 3 - Edition 2: On the concept of circular economy to revive local production and consumption", Lebanon Talks, available online at <https://www.youtube.com/watch?v=XZWwnA8ntml>
- 51 UNDP (2019) "Value Chain Assessment and Analysis: Executive Summary and Recommendations", Country Entrepreneurship for Distributed Renewables Opportunities, online at https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjc5a3_pejzAhWh0eAKHW_qDY4QFnoECAMQAQ&url=https%3A%2F%2Fdata2.unhcr.org%2Fen%2Fdocuments%2Fdownload%2F68102&usg=AOvVaw3-b_dvH3VUKmQtmIZ3Adp_
- 52 UNEP (2021) "How can developing countries promote a green recovery in the context of low-carbon policy and economic growth?", United Nations Environment Programme, speech available at <https://www.unep.org/news-and-stories/speech/how-can-developing-countries-promote-green-recovery-context-low-carbon>
- 53 ILO (2011) "Green Jobs Assessment in Lebanon: Synthesis Report", International Labour Organisation, online at: https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/documents/publication/wcms_168091.pdf
- 54 Mitchell, Gabriel (2021), "As Israel and Jordan face an environmental squeeze, they must rebuild trust", Atlantic Council, online at: <https://www.atlanticcouncil.org/blogs/menasource/as-israel-and-jordan-face-an-environmental-squeeze-they-must-rebuild-trust/>
- 55 ACTED (2021) "Circularity As A Lifeline For MENA Economies In Distress" Online At [Https://Reliefweb.Int/Report/Yemen/Circularity-Lifeline-Mena-Economies-Distress](https://Reliefweb.Int/Report/Yemen/Circularity-Lifeline-Mena-Economies-Distress)
- 56 SwitchMed (2021), "Regional Summary of Policy Recommendations to Support the Development of Green and Circular Businesses in the Mediterranean", Regional Activity Centre for Sustainable Consumption and Production, online at https://switchmed.eu/wp-content/uploads/2020/12/SwitchMed_Regional-Summary-of-Policy-Recommendations.pdf
- 57 UNDP (2019) "Value Chain Assessment and Analysis: Executive Summary and Recommendations", Country Entrepreneurship for Distributed Renewables Opportunities (CEDRO), online at https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjc5a3_pejzAhWh0eAKHW_qDY4QFnoECAMQAQ&url=https%3A%2F%2Fdata2.unhcr.org%2Fen%2Fdocuments%2Fdownload%2F68102&usg=AOvVaw3-b_dvH3VUKmQtmIZ3Adp_
- 58 UNDP (2017). Lebanon: Derisking Renewable Energy Investment. New York, NY: United Nations Development Programme, online at <https://www.cedro-undp.org/publications/lebanon-de-risking-renewable-energy-investment>



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